

CLAIMS

1. A vibrating device having:

a housing supported by a base and capable of oscillating
5 relative to the base in a vibration frequency range of a
vibrator; and

an expandable rod that can expand and contract, one end
of which is fixed to the housing, and the other end of which
is a free end contacting the base, wherein

10 the base is resonated by oscillation of the housing in
the vibration frequency range of a vibrator, and the base is
vibrated by expansion and contraction of the expandable rod in
a sound frequency range other than the vibration frequency
range of a vibrator.

15 2. The vibrating device according to claim 1, wherein
the housing includes an inertial mass member, and the one
end of the expandable rod is fixed to the inertial mass member.

3. The vibrating device according to claim 1 or 2,
wherein

20 the housing is supported on the base by a support member
having vibration transmission characteristics that allow
oscillation of the housing in the vibration frequency range of
a vibrator and restrict oscillation of the housing in the
sound frequency range.

25 4. The vibrating device according to claim 3, wherein

the support member supports part of the housing such that the housing can oscillate around the vicinity of the part acting as a fulcrum point, and supports another part of the housing a distance away from the part via a resilient member
5 having the vibration transmission characteristics.

5. The vibrating device according to claim 3, wherein the support member supports the housing in a suspended state such that the housing can oscillate around the free end of the expandable rod acting as a fulcrum point, and has a
10 resilient member having the vibration transmission characteristics in a direction of oscillation of the housing.

6. The vibrating device according to any one of claims 1 to 5, wherein

at least part of the expandable rod is formed of a
15 displacement rod made of a displacement element.

7. The vibrating device according to claim 6, wherein the expandable rod is formed of the displacement rod and a transmission rod having the free end for transmitting a displacement in the displacement rod to the base, the free end
20 of the transmission rod being contacted to the base at a position offset from an axial center of the displacement rod.

8. The vibrating device according to claim 6 or 7, wherein

the displacement rod is made of a magnetostrictive
25 element including a giant magnetostrictive element.

9. The vibrating device according to claim 8, further comprising:

a biasing magnet arranged at both axial ends of the displacement rod made of the magnetostrictive member, for
5 applying a bias magnetic field to the displacement rod in an axial direction; and

a magnet coil arranged to surround the displacement rod, for causing the displacement rod to expand and contract by controlling intensity of the applied magnetic field.

10 10. A mobile phone characterized in that the vibrating device according to any one of claims 1 to 9 is provided in a casing.

11. The mobile phone according to claim 10, wherein
the casing serves as a speaker of a receiver for
15 generating a conversation sound, a speaker of a call alert buzzer, and a vibrating member of a call alert vibrator.

12. The mobile phone according to claim 11, wherein
the vibrating device serves as a speaker vibrating device
of the receiver, a speaker vibrating device of the call alert
20 buzzer, and a vibrating device of the call alert vibrator.

13. The mobile phone according to claim 11 or 12, wherein
the speaker of the receiver is a bone conduction speaker
that uses the principle of bone conduction.